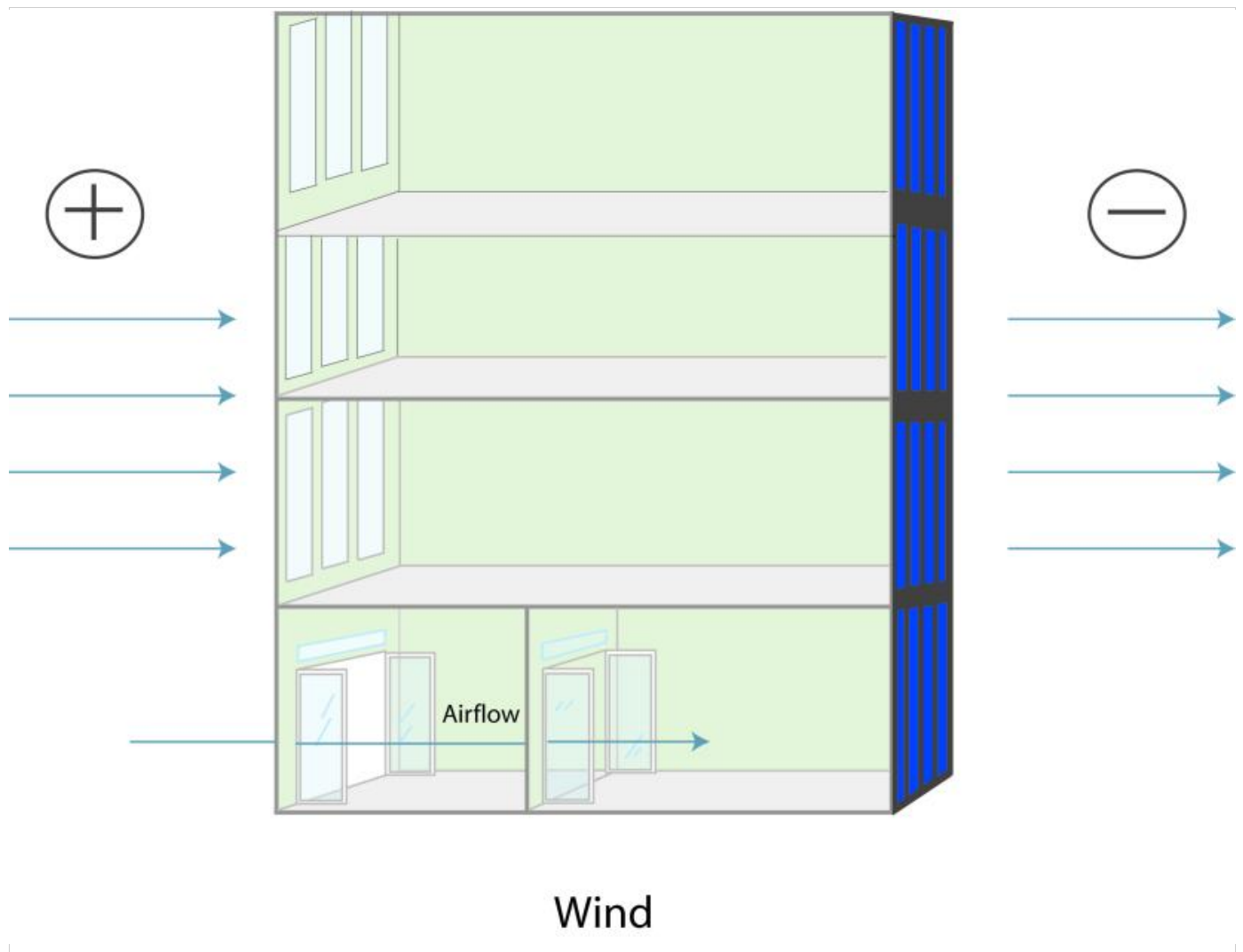
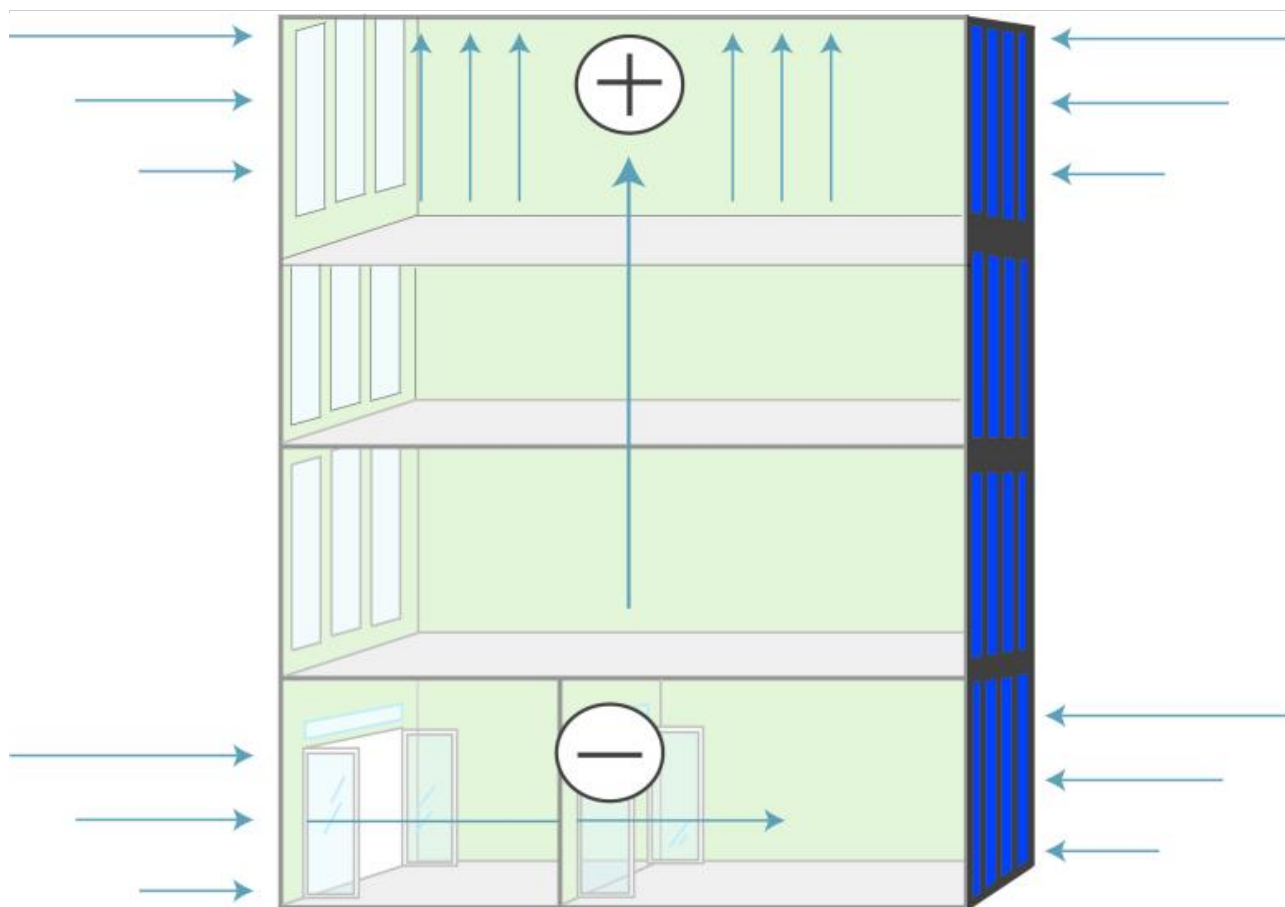


## Vestibule Case Study

[2003 IECC, 2006 IECC, 2003 IBC, 2006 IBC, 90.1-2001, 90.1-2004]

### Vestibule Requirement Intent



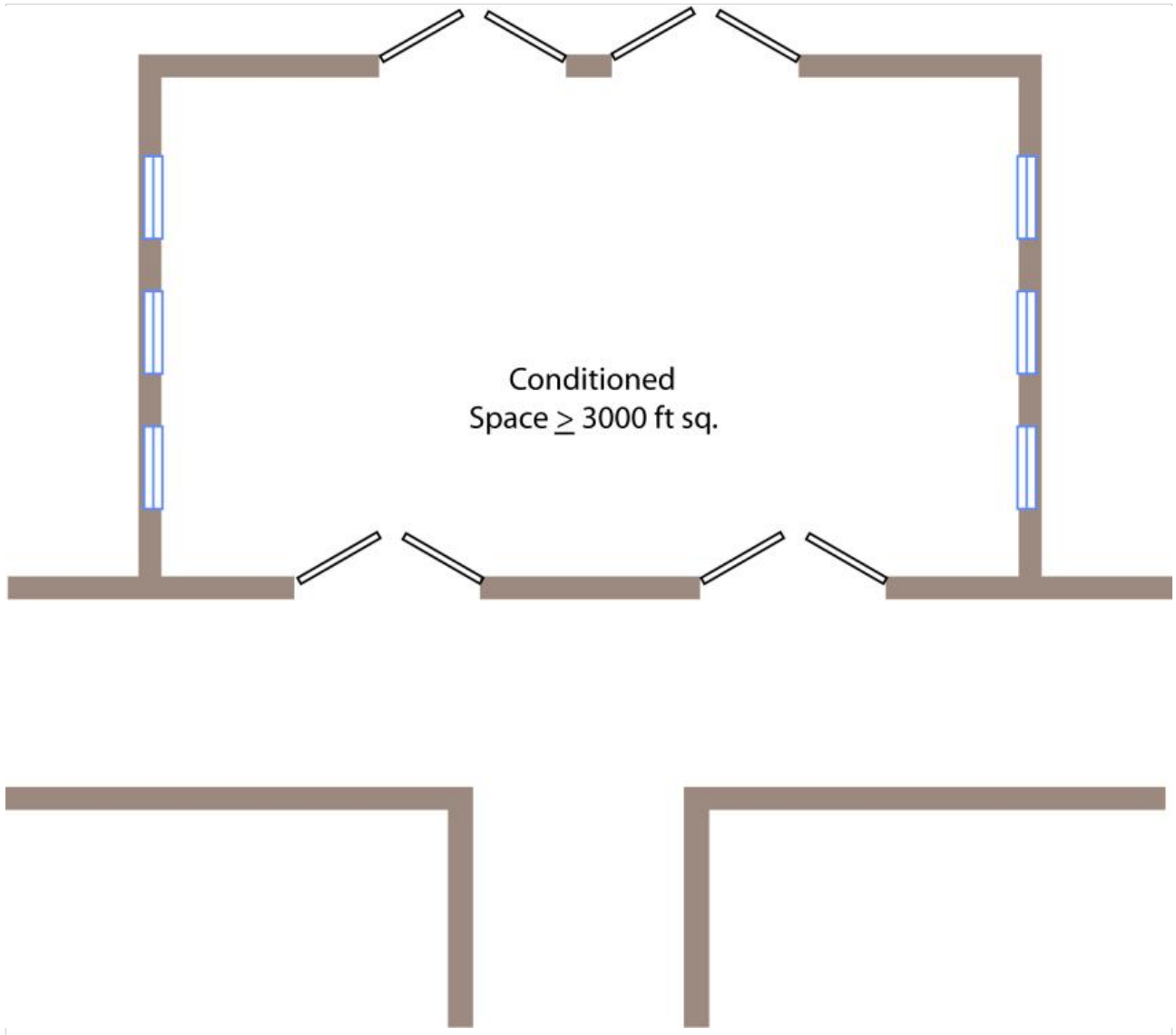


## Stack

The primary intent behind the requirement for a vestibule is to reduce infiltration into a space that includes doors with high volume of pedestrian traffic. These doors are typically used by the general public to access public areas and have a higher usage rate than a door classified for personnel use. Vestibules reduce the infiltration losses (or gains) from wind and stack effect by creating an air lock entry. The stack effect caused by naturally occurring warm air rising, is greater in taller buildings than in low rise construction but under the provisions of the 2003 and 2006 IECC no allowance is made for building height or number of stories. Wind exposure is dependant on the orientation of the building and greater infiltration driver in low-rise commercial buildings verses stack effect.

## When Is A Vestibule Required?

Vestibules are required in Chapter 8 of the 2003 IECC (Section 802.3.6), Chapter 5 of the 2006 IECC (Section 502.4.6), ANSI/ASHRAE/IESNA Standard 90.1-2001 (Section 5.5.3.4), and Standard 90.1-2004 (Section 5.4.3.4). Essentially a vestibule is required on the primary entrance doors leading from spaces in a building greater than or equal to 3000 ft<sup>2</sup>. Both the IECC and 90.1 have similar requirements for when a vestibule is required and the configuration of the vestibule. However, 90.1-2001 and 90.1-2004 exempt vestibules in buildings less than four stories.



A lobby surrounded by floor-to-ceiling partitions, a roof/ceiling assembly and floor assembly could be considered a space. The lobby walls can contain operable windows and doors that isolate the space from the adjoining spaces or the exterior.

The IECC, 90.1-2001 and 90.1-2004 **[1]** require vestibules for "spaces" that are 3000 ft<sup>2</sup> or greater. This is not the building area but a space within a building. For example, an entrance to a 2000 ft<sup>2</sup> retail store with a 1,500 ft<sup>2</sup> storage area, closed off by doors, would not require a vestibule. However, a 4000 ft<sup>2</sup> retail space with an entrance door to a sales area of 3000 ft<sup>2</sup> would be required to have a vestibule.

In some circumstances, it is difficult to define where one space ends and another begins for the purposes of calculating whether the size of the space with an outside entrance door requires a vestibule. An example of this is a 2000 ft<sup>2</sup> lobby with one wall substantially open to a larger adjacent lounge. In such a case, the two areas should probably be considered a single space, and a vestibule should be required. The following definition is offered by 90.1-2001 and 90.1-2004 and provides some guidance:

**Space.** The following definition is offered by 90.1-2001 and 90.1-2004:

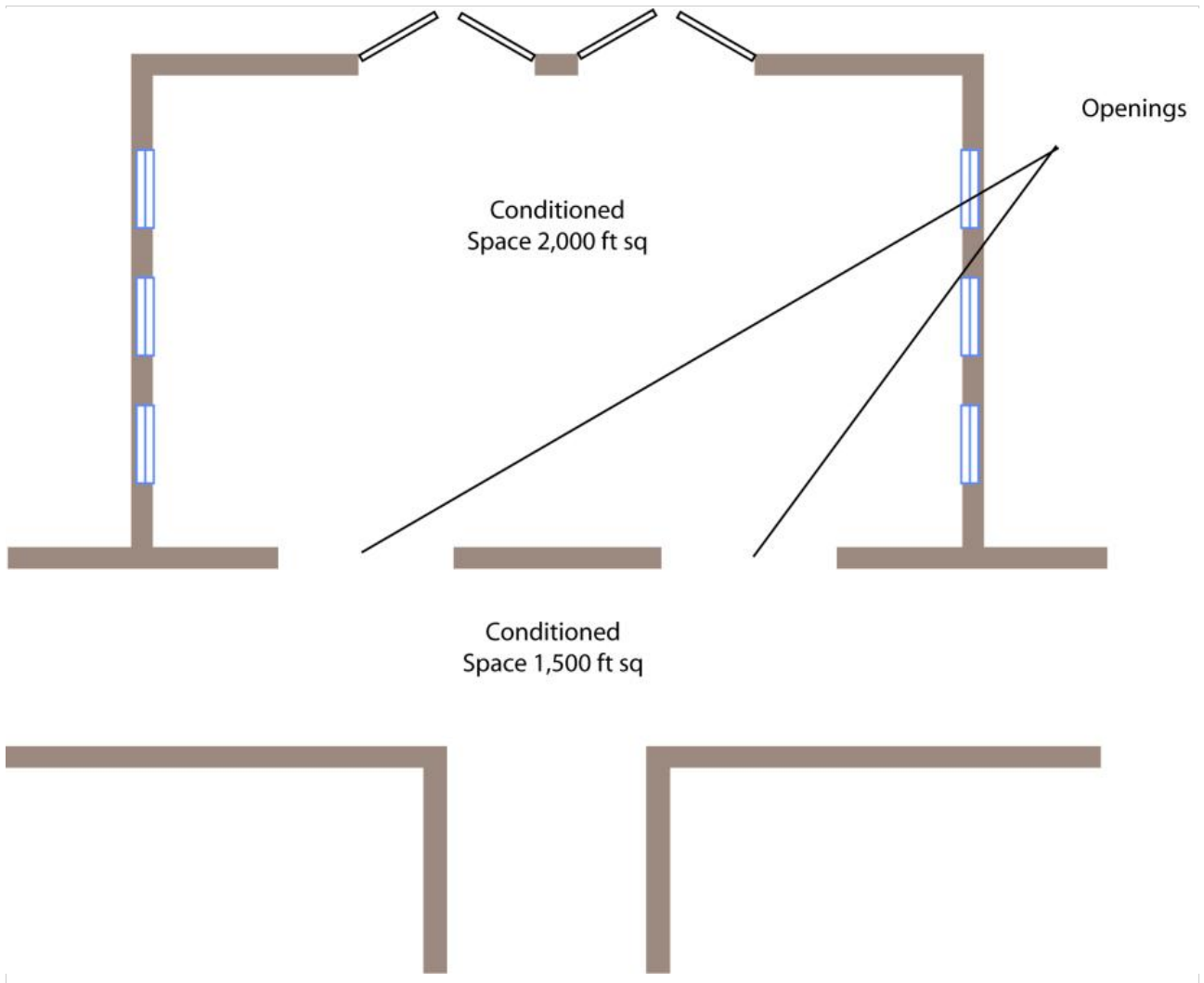
*"A volume substantially surrounded by solid surfaces such as walls, floors, roofs and operable devices such as doors and operable windows."*



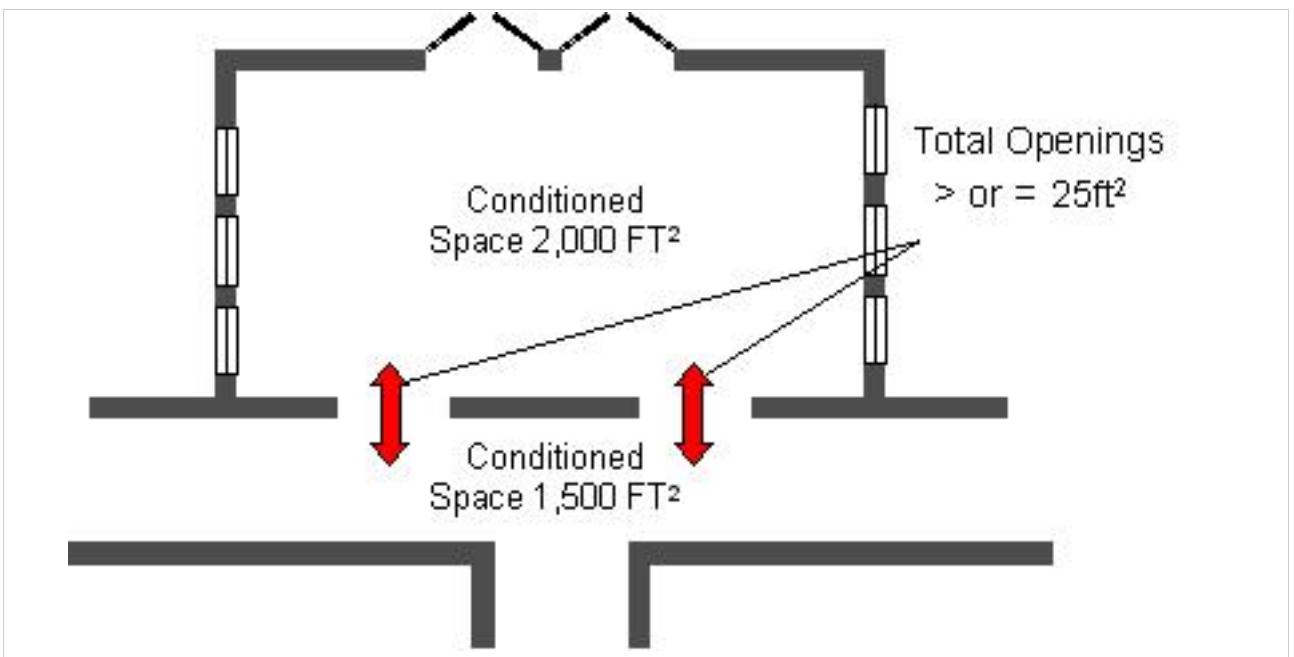
The word "substantially" must be interpreted for the purpose of determining the need for a vestibule. Unfortunately, the IECC has no such definition.



**Doors.** Based on the exceptions that apply to the IECC, 90.1-2001 Standard and Users Manual, and 90.1-2004 Standard and Users Manual, the doors that are affected by this requirement are doors intended as entrances to the building that receive pedestrian traffic from both the general public and building occupants. For example, the doors leading into a public lobby would be required to have a vestibule where doors leading to service areas, mechanical rooms, electrical rooms or exits from fire stairways would be exempt. Personnel doors adjacent to doors used to facilitate vehicular movement or material handling are exempt. For example, a door adjacent to a loading dock would be exempt.





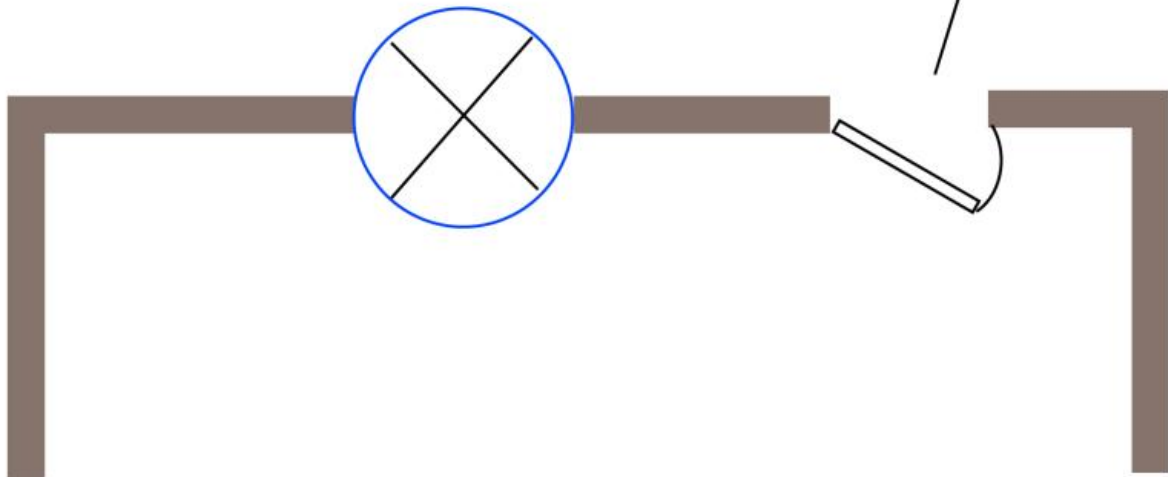


If the building has more than one entrance into a space 3000 ft<sup>2</sup> or greater, each of the doors must have a vestibule. For example, a gas station/convenience store may include two entrances into the open store area. If the space is 3000 ft<sup>2</sup> or greater each of the entrances would be required to have a vestibule.



Revolving Doors  
Exempt

IBC 1008.1.3.1  
Side-Hinged swinging door  
is 10ft from revolving door



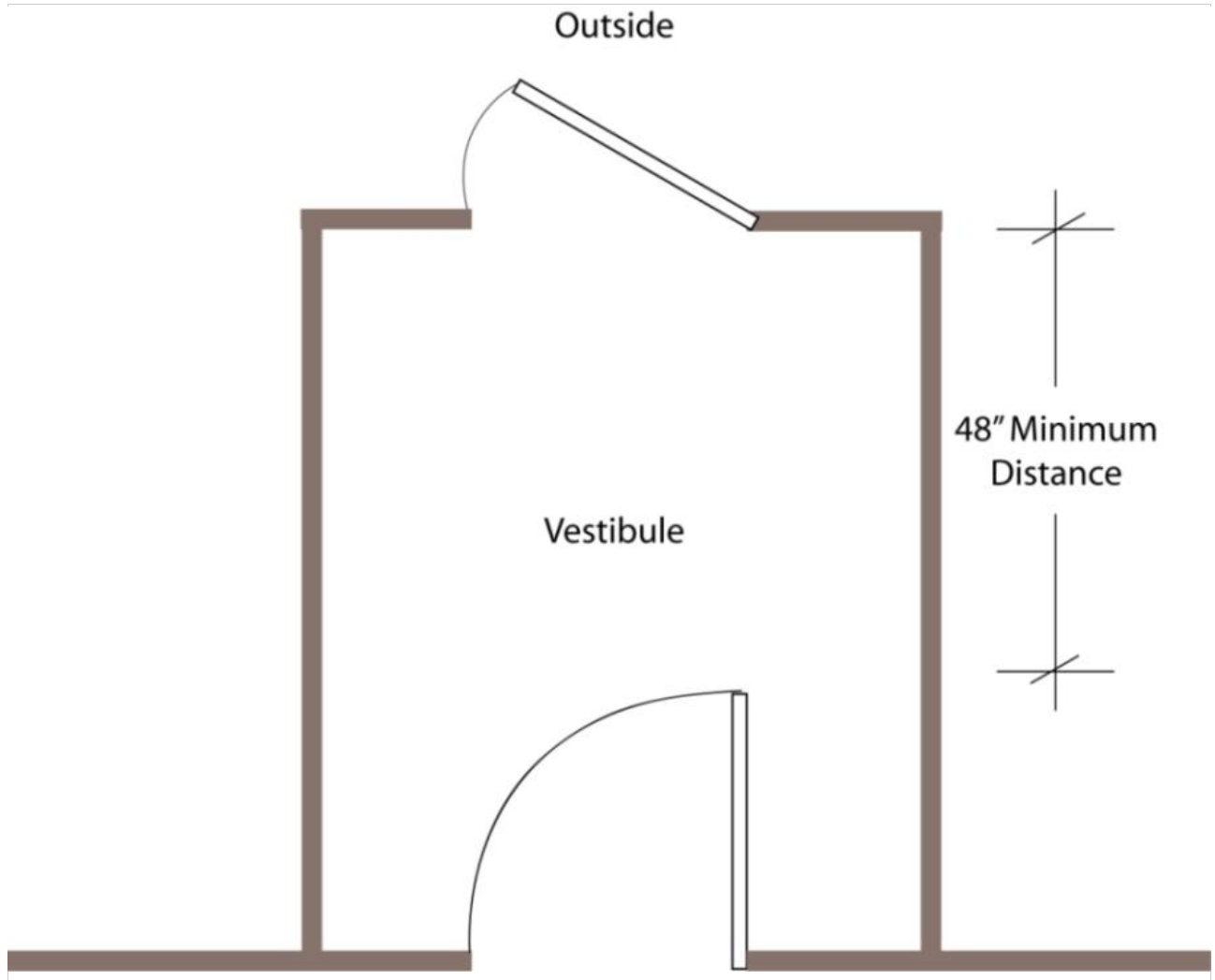




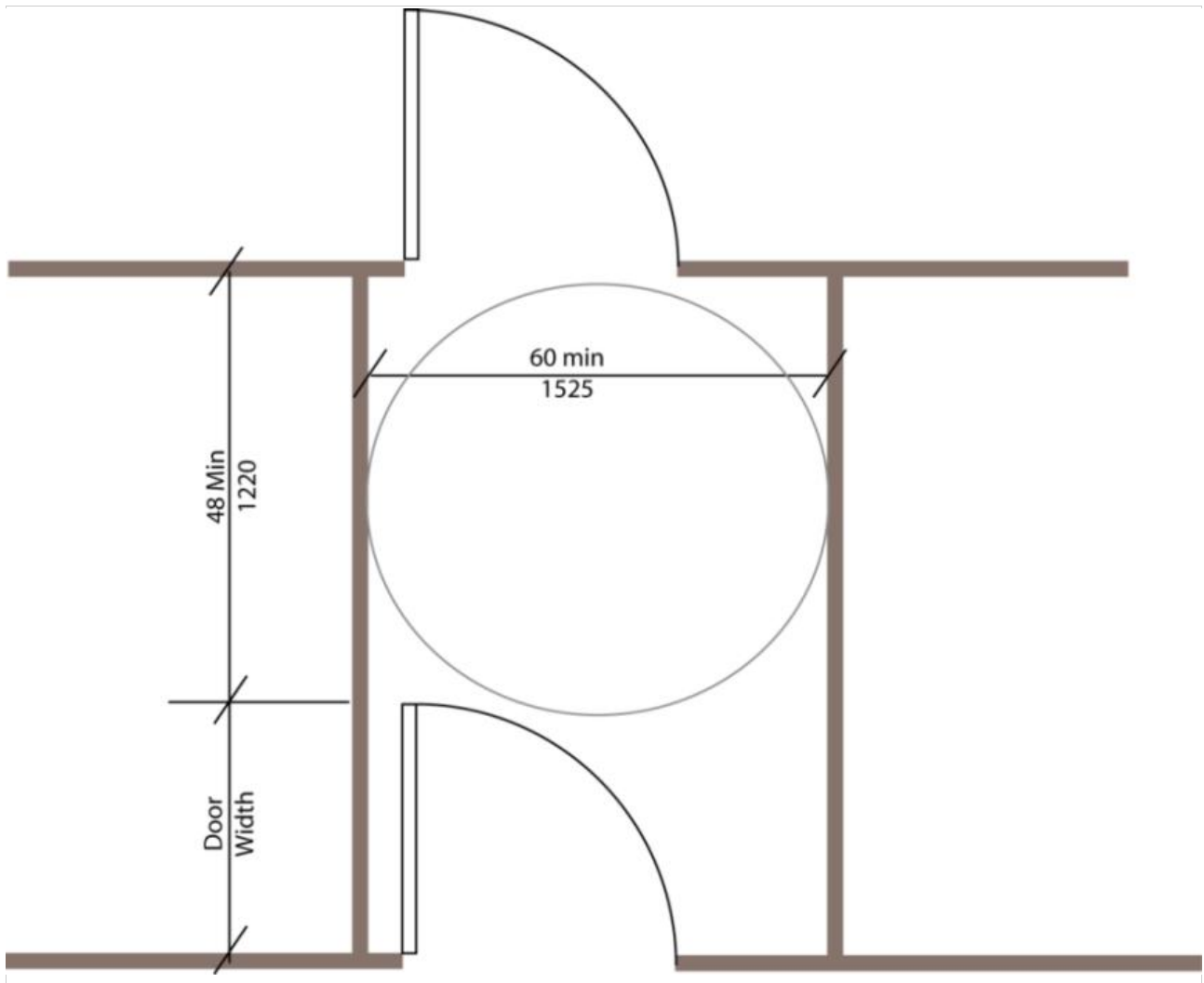
The 2003 and 2006 IECC, and the 90.1-2001 and 90.1-2004 provide an exemption from the vestibule requirement in entrances that use revolving doors as they provide adequate protection against infiltration into the space. If a revolving door is used in place of a vestibule, the 2003 and 2006 IBC Section 1008.1.3.1 require that a side-hinged swinging door must also be installed within 10 feet of the revolving door.

Doors are also required to have self closing devices. A door closure system on a swinging door would meet the intent of the requirement as would a power operated door -- such as a door with a motion-actuated mechanism to open the door upon the approach of a person.





**Vestibule Dimensions.** The IECC provides guidance to determine the minimum depth of the vestibule by requiring that the vestibule must be designed so that it is not necessary to open doors leading into and out of the vestibule at the same time in order to pass through. This requirement allows a person to enter the vestibule, have the door shut behind them and then exit the vestibule while maintaining an air lock to reduce infiltration. The requirements in 90.1-2001 and 90.1-2004 are identical except that a minimum of seven feet is also required between the doors leading out of the vestibule when the doors are in the closed position.



ICC/ANSI A117.1-98 Accessible and Usable Buildings and Facilities (A117.1-98), referenced in the 2003 IBC (see Code Reference section), provides a requirement for minimum distances between two doors in a series, such as in a vestibule configuration. A117.1-98 requires that the distance between the two hinged or pivoted doors that are in series must have a minimum distance of 48" between them plus the width of the door swinging into the space. For example, if the door swing into the space is 34" the minimum distance that would be required would be 82".

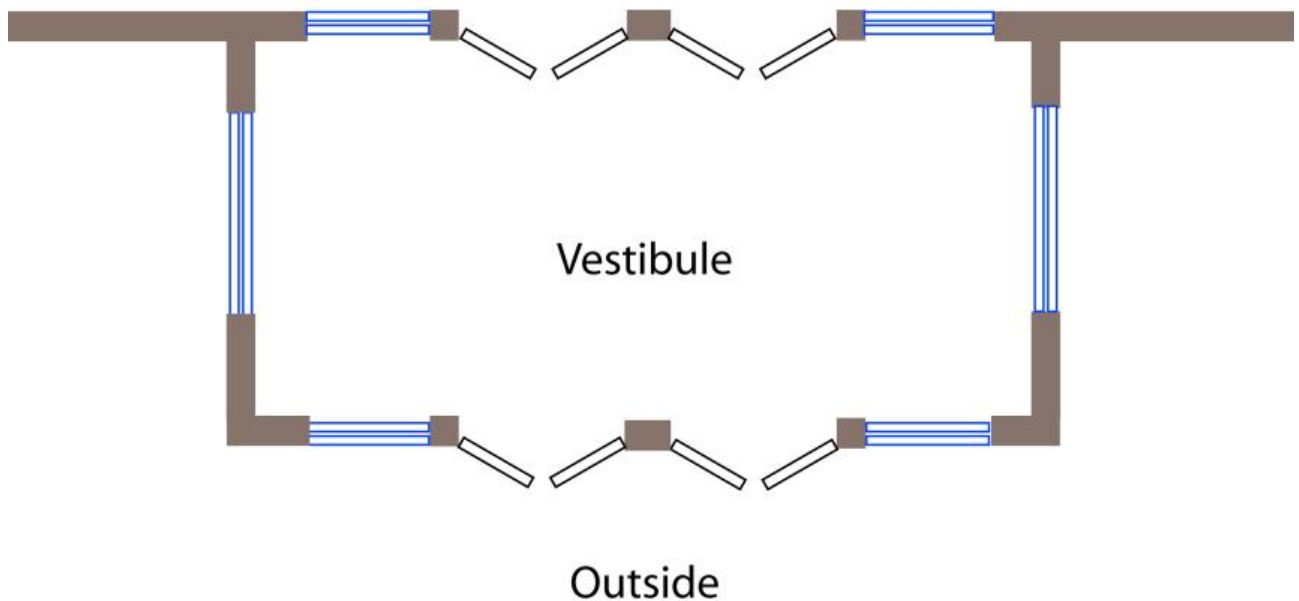
In addition to the minimum depth of the vestibule, A117.1-98 also places requirements on the minimum width that a vestibule can be. A minimum of a 60" turning diameter is required to be able to turn a wheelchair in the vestibule.

## Compliance with the Code

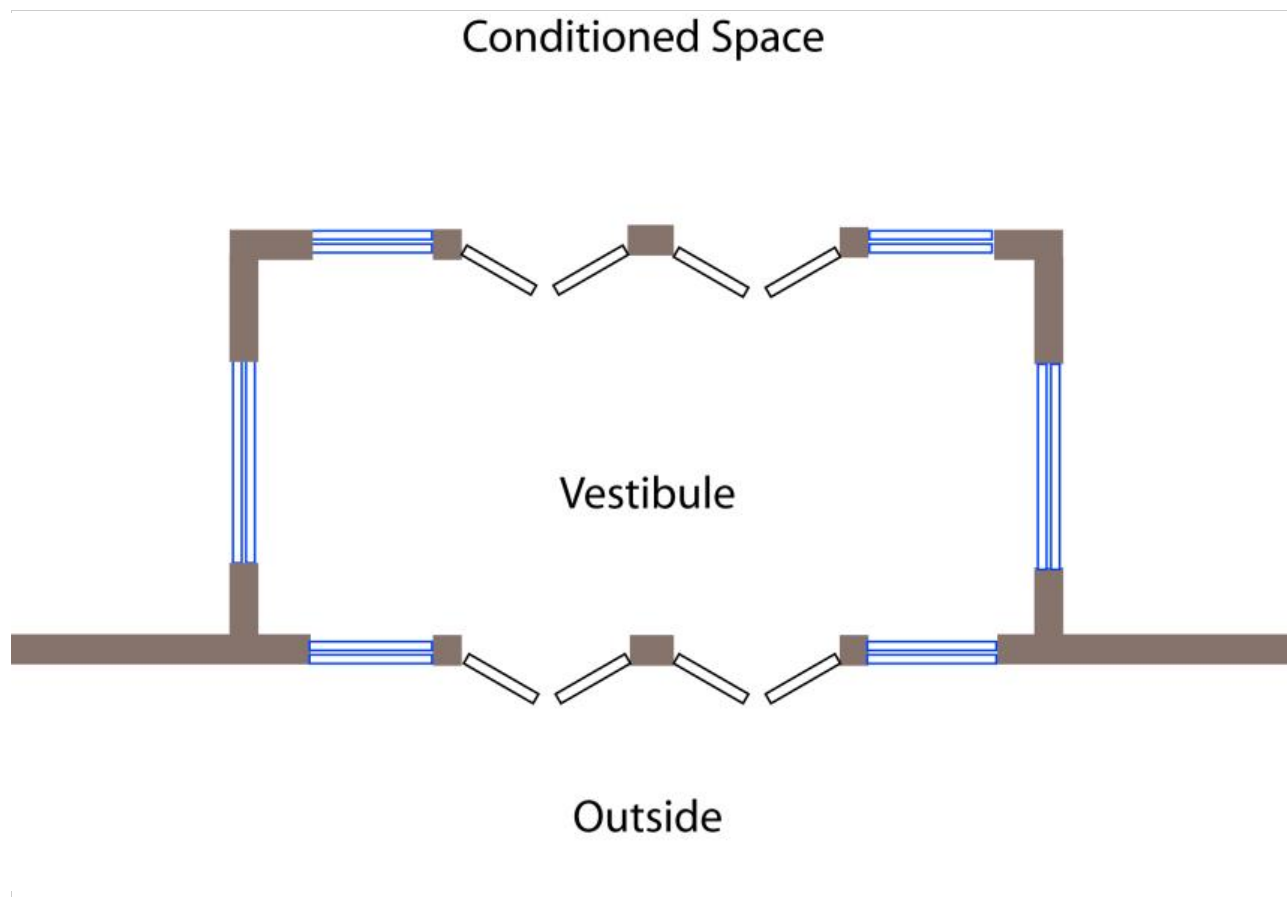
The first step in determining compliance with the envelope requirements of the IECC is to determine the boundary of the building envelope. The vestibule requirement specifies that a door that separates conditioned space from the exterior is to have a vestibule. Because the door is specified as an exterior door, the wall assembly that contains the door is considered part of the building envelope and therefore must comply with the IECC.



## Conditioned Space



Two common vestibule configurations are provided as examples on defining the building envelope. A common vestibule installation example is to have the vestibule protruding from the exterior of the building to protect the exterior doors. In this example the items associated with the red walls are considered to be part of the building envelope and therefore must comply with the IECC. Because the vestibule now forms an unconditioned space, the wall, window and door assemblies that separate the conditioned space from the vestibule can meet the interior wall requirement. The walls must meet the R-value requirements based on construction type. In addition, the windows and doors must meet the maximum U-factor and SHGC requirements based on the 0 - 10% glazing percentage. The glazing, doors and opaque surfaces associated with the vestibule itself are not covered under the provisions of the IECC.



Another example of a vestibule configuration is to have the vestibule come into the conditioned space instead of protruding from the building. In this scenario, the walls and glazing assemblies that surround the vestibule (see red assemblies) must meet the interior wall requirements (Chapter 8 of the 2003 IECC and Chapter 5 of the 2006 IECC). The door and wall assemblies that form the wall between the vestibule and the exterior (see grey assemblies) would be exempt.

## Compliance with the International Building Code

In addition to meeting the requirements of the IECC or 90.1-2001/90.1-2004, vestibules must also be designed to meet the requirements of the International Building Code for means of egress and accessibility.

## Code Citations\*

### IECC 2003 Section 802.3.6 and IECC 2006 Section 502.4.6 Vestibules

A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time.

#### Exceptions:

1. Buildings in Climate Zones 1a through 4b as indicated in Table 302.1 (See [Energy Code Climate Zones](#)) [2003 IECC]; Buildings in Climate Zones 1 and 2 as indicated in Table 301.1 [2006





IECC].

2. Doors not intended to be used as a building entrance door, such as doors to mechanical or electrical equipment rooms.
3. Doors opening directly from a guestroom or dwelling unit [2003 IECC]; Doors opening directly from a sleeping unit or dwelling unit [2006 IECC].
4. Doors that open directly from a space less than 3,000 square feet (298 m<sup>2</sup>) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

#### **ANSI/ASHRAE/IESNA Standard 90.1-2001 Section 5.5.3.4 and 90.1-2004 Section 5.4.3.4 Vestibules**

A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. Interior and exterior doors shall have a minimum distance between them of not less than 7 ft when in the closed position.

##### **Exceptions:**

1. Doors in buildings in climates that have less than 1800 HDD65 [90.1-2001]; Buildings in Climate Zones 1 and 2 [90.1-2004].
2. Doors in buildings less than four stories above grade
3. Doors not intended to be used as a building entrance door, such as mechanical or electrical equipment rooms
4. Doors opening directly from a dwelling unit
5. Doors that open directly from a space less than 3000 ft<sup>2</sup> in area
6. Doors in building entrances with revolving doors
7. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

#### **2003 and 2006 IBC Section 1203.4.1.1 Adjoining spaces.**

Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining rooms shall be unobstructed and shall have an area not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.3 m<sup>2</sup>). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

#### **ICC/ANSI A117.1-2003 Two Doors In Series**

Distance between two hinged or pivoted doors in series shall be 48 inches minimum plus the width of any door swinging into the space. The space between the doors shall provide a turning space complying with Section 304.

**2003 and 2006 IBC Section 1008.1.3.1 Revolving doors**

Revolving doors shall comply with the following:

Each revolving door shall have a side-hinged swinging door which complies with Section 1008.1 in the same wall and within 10 feet (3048 mm) of the revolving door.

**2003 IBC Section 1023.1 and 2006 IBC Section 1024.1 General Exception 2.**

A maximum of 50 percent of the number and capacity of the exit enclosures is permitted through a vestibule provided all of the following are met:

1. The entire area of the vestibule is separated from the areas below by construction conforming to the fire-resistance rating for the exit enclosure.
2. The depth from the exterior of the building is not greater than 10 feet (3048 mm) and the length is not greater than 30 feet (9144 mm).
3. The area is separated from the remainder of the level of exit discharge by construction providing protection at least the equivalent of approved wired glass in steel frames.
4. The area is used only for means of egress and exits directly to the outside.

Note: **[1]** ASHRAE 90.1-2001 and 90.1-2004 have an exemption for the number of floors in the building. See Section 5.5.3.4 and Section 5.4.3.4.

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